



Black-tailed Prairie Dog Monitoring at Scotts Bluff National Monument: Annual Status Report 2006

Natural Resource Technical Report NPS/HTLN/NRTR—2006/020



ON THE COVER

Black-tailed prairie dog (*Cynomys ludovicianus*)

Photos from The Heartland Inventory and Monitoring Network and Prairie Cluster Prototype Monitoring Program files.

Black-tailed Prairie Dog Monitoring at Scotts Bluff National Monument: Annual Status Report 2006

Natural Resource Technical Report NPS/HTLN/NRTR—2006/020

Brittany A. Hummel, J. Tyler Cribbs and David G. Peitz
National Park Service
The Heartland I&M Network and Prairie Cluster Prototype Monitoring Program
Wilson's Creek National Battlefield
6424 West Farm Road 182
Republic, MO 65738



August 2006

U.S. Department of the Interior
National Park Service
Natural Resource Program Center
Fort Collins, Colorado

The Natural Resource Publication series addresses natural resource topics that are of interest and applicability to a broad readership in the National Park Service and to others in the management of natural resources, including the scientific community, the public, and the NPS conservation and environmental constituencies. Manuscripts are peer-reviewed to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and is designed and published in a professional manner.

The Natural Resource Technical Report series is used to disseminate the peer-reviewed results of scientific studies in the physical, biological, and social sciences for both the advancement of science and the achievement of the National Park Service's mission. The reports provide contributors with a forum for displaying comprehensive data that are often deleted from journals because of page limitations. Current examples of such reports include the results of research that addresses natural resource management issues; natural resource inventory and monitoring activities; resource assessment reports; scientific literature reviews; and peer reviewed proceedings of technical workshops, conferences, or symposia.

Views and conclusions in this report are those of the authors and do not necessarily reflect policies of the National Park Service. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the National Park Service.

Printed copies of reports in these series may be produced in a limited quantity and they are only available as long as the supply lasts. This report is also available from the Heartland I&M Network website (<http://www.nature.nps.gov/im/units/HTLN>) on the internet, or by sending a request to the address on the back cover.

Please cite this publication as:

B. A. Hummel, J. T. Cribbs and D. G. Peitz. 2006. Black-tailed Prairie Dog Monitoring at Scotts Bluff National Monument: Annual Status Report 2006. Natural Resource Technical Report NPS/HTLN/NRTR—2006/020. National Park Service, Fort Collins, Colorado.

Table of Contents

	Page
Table of Contents.....	iii
Figures.....	iv
Tables.....	v
Executive Summary	vi
Acknowledgment	vii
Introduction.....	1
Background.....	1
Objectives	2
Methods.....	3
Black-tailed Prairie Dog Density and Abundance	3
Black-tailed Prairie Dog Colony Mapping	4
Sylvatic Plague Surveillance.....	4
Results.....	5
Black-tailed Prairie Dog Density and Abundance	5
Black-tailed Prairie Dog Colony Mapping	8
Sylvatic Plague Surveillance.....	9
Other Observations	10
Discussion	10
Plans for 2007	12
Literature Cited.....	13

Figures

Page

Figure 1. Black-tailed prairie dog (<i>Cynomys ludovicianus</i>) colony sizes and shapes at Scotts Bluff National Monument, Nebraska – Main Colony for years 1995 to 2006	3
Figure 2. Annual estimates of black-tailed prairie dog densities (<i>Cynomys ludovicianus</i>) at Scotts Bluff National Monument, Nebraska – Main Colony for years 1995 to 2006.	6
Figure 3. Annual estimates of black-tailed prairie dog population sizes (<i>Cynomys ludovicianus</i>) at Scotts Bluff National Monument, Nebraska – Main Colony for years 1995 to 2006.....	7
Figure 4. Black-tailed prairie dog (<i>Cynomys ludovicianus</i>) colony locations at Scotts Bluff National Monument during 2006.....	9
Figure 5. Cumulative precipitation for the first seven months of each year, shown annually as deviations from the twelve year average (1995-2006) at Scotts Bluff National Monument, Nebraska.	11

Tables

Page

Table 1. Annual colony size, population density and number of individual black-tailed prairie dogs (<i>Cynomys ludovicianus</i>) at Scotts Bluff National Monument, Nebraska – Main Colony, between colony reestablishment and 1994.	4
Table 2. Annual colony size (95% CI), population density (95% CI) and number of individual black-tailed prairie dogs (<i>Cynomys ludovicianus</i>) at Scotts Bluff National Monument, Nebraska - Main Colony, between 1995 and 2006.	5
Table 3. Annual colony size (95% CI), population density (95% CI) and number of individual black-tailed prairie dogs (<i>Cynomys ludovicianus</i>) at Scotts Bluff National Monument, Nebraska - North Colony, between 2003 and 2006.	7
Table 4. Annual colony size (95% CI), population density (95% CI) and number of individual black-tailed prairie dogs (<i>Cynomys ludovicianus</i>) at Scotts Bluff National Monument, Nebraska - Saddle Rock Unit colony, between 2003 and 2006.	8

Executive Summary

Using methodologies outlined by Plumb et al. (1999), black-tailed prairie dog populations were monitored for the 12th consecutive year on Scotts Bluff National Monument. The main colony population declined in size and density from the previous year. Density was below the 12-year average. However, population size was well above the 12-year average. The area occupied by prairie dogs on the main colony was greater than the previous year and above the 12-year average. Areas occupied by the prairie dogs north of the canal and in the Saddle Rock unit of the monument were up from the previous year. However, populations on both had declined slightly. Evidence of Sylvatic plague, a bacterium fatal to prairie dogs, was not observed in the three populations in 2006. Four burrowing owls were observed during black-tailed prairie dog surveys on the main colony.

Acknowledgements

We would like to thank the staff at Scotts Bluff National Monument for assisting us with monitoring. We would especially like to thank Bob Manasek for his assistance with setting up observation stands and for monitoring the colony throughout the year for the presence of Sylvatic plague.

Introduction

Background

Black-tailed prairie dogs (*Cynomys ludovicianus*, BTPD) historically occupied over 100 million acres of shortgrass and mixed-grass prairie in 11 western states (National Wildlife Federation 2000a). Currently, less than one percent of this habitat is believed to be occupied (700,000 to 800,000 acres). The dramatic decline in BTPD habitat and abundance is the result of changing land use patterns, habitat fragmentation, disease, shooting and poisoning (U.S. Fish and Wildlife Service 2000). Sylvatic plague (*Yersinia pestis*), introduced from Europe and first identified in prairie dog populations in the mid-1930's (Hubbard 1947), is capable of causing massive die-offs in prairie dog populations (Barnes 1993, Cully 1993). Widespread control of prairie dogs through shooting and poisoning is still practiced in some states. Most states required the eradication of BTPD on both private and public held lands at the expense of the landowner (Desmond et al. 2000). This requirement for eradication of BTPD was relaxed in many states when the Fish and Wildlife Services ruled the species warranted listing as threatened under the Endangered Species Act of 1973 (US Fish and Wildlife Service 2000). The BTPD has since been removed as a candidate for protection under the Endangered Species Act (U.S. Fish and Wildlife Service 2004). However, during the four and a half years that the BTPD warranted listing as a threatened species, considerable effort and resources were invested by federal, state, tribal, private landowners, and conservation organizations to better understand the status of the species and design and implement conservation strategies to reduce threats to the species.

Species dependent on the BTPD for food or the habitat they create include the burrowing owl (*Athene cunicularia*), mountain plover (*Charadrius montana*), kit fox (*Vulpes velox*) and ferruginous hawk (*Buteo regalis*) (National Wildlife Federation 2000b). These species are candidates or potential candidates for listing as threatened species under the Endangered Species Act. The most endangered mammal in the United States, the black-footed ferret (*Mustela nigripes*), is wholly dependent on the prairie dog for its survival (National Wildlife Federation 2000b).

Concerns for recovery of the BTPD to stable numbers on National Park Service (NPS) lands have prompted the NPS to identify parks and monuments within the historic range of the BTPD that still host populations and to monitor these populations. Seven of the 29 parks or monuments within the historic range of the BTPD still maintain populations (Badland's National Park, SD; Bent's Old Fort National Historic Site, CO; Devil's Tower National Monument, WY; Fort Larned National Historic Site, KS; Scotts Bluff National Monument, NE; Theodore Roosevelt National Park, ND; and Wind Cave National Park, SD).

In 1981, the main colony of BTPD at Scotts Bluff National Monument, Nebraska (SCBL) reestablished from vagrant individuals moving onto the monument. BTPD had been exterminated from the monument in 1944. Colony size, population densities, and estimates of overall abundance of BTPD at SCBL from 1981-1994 are given in Table 1. The rapid and sustained decline in BTPD numbers between 1988 and 1995 could be the result of several factors including illegal shooting or poisoning, poor winter survival, predation, or Sylvatic plague (Knowles 1998).

For the period 1995-1999, BTPD were monitored through a joint effort of the Heartland Network and Prairie Cluster Prototype Inventory and Monitoring Program (HTLN) and the Biological Resources Division (BRD) of the U.S. Geological Survey. A peer-reviewed monitoring protocol was the result of this endeavor (Plumb et al. 2001). Park personnel and HTLN staff continue annual BTPD monitoring. This report describes monitoring results for 2006.

Table 1. Annual colony size, population density and number of individual black-tailed prairie dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska – Main Colony, between colony reestablishment and 1994. Sources of annual data are indicated.

Year	Area (ha)	Density (individuals/ha)	Population Size	Source
1981	Colony Reestablishment in Scott's Bluff National Monument			
1982	--	--	--	None
1983	0.98	76.5	75	Franklin 1984
1984	1.31	30.5	40	Franklin 1984
1985	--	--	107	Cox and Franklin 1989
1986	5.77	34.7	200	Cox and Franklin 1989
1987	5.14	58.9	303	Cox and Franklin 1989
1988	3.39	64.6	219	Cox and Franklin 1989
1989	--	--	62	Monument Personnel unpub.
1990	--	--	62	Monument Personnel unpub.
1991	--	--	27	Monument Personnel unpub.
1992	--	--	--	None
1993	--	--	45	Monument Personnel unpub.
1994	--	--	--	None

Objectives

The objectives of BTPD monitoring at SCBL are to: 1) estimate BTPD population abundance; 2) map annual size and location of the BTPD colonies; and 3) determine through observation if Sylvatic plague (*Yersinia pestis*) is present in BTPD colonies.

Methods

Black-tailed Prairie Dog Density and Abundance

Plumb et al. (2001) detail the current monitoring methods used to estimate BTPD densities, abundance and colony sizes. To facilitate a more accurate observation of an area obstructed from view in 2005, a third observer and stand was added. Eight replicate counts, with 15-minute intervals between the start of each replicate were made from each stand. Counts were conducted on three consecutive days, July 21, 22, and 23. Using landscape features, a section of the colony was defined for observation from each of the stands in an effort to minimize counting individuals twice during a replicate. Stands were placed in eastern, central, and southern locations on the colony to best facilitate the observation of BTPD (Figure 1). Counts from each stand were synchronized so that a colony wide estimate could be derived. Daily replicate counts from each stand were combined in order to calculate estimates of population density and size. Surveys were conducted between 6:45am – 8:45am on mornings with little or no precipitation. Population surveys of the Saddle Rock Unit colony and the colony north of the canal were conducted concurrently with the main colony count.

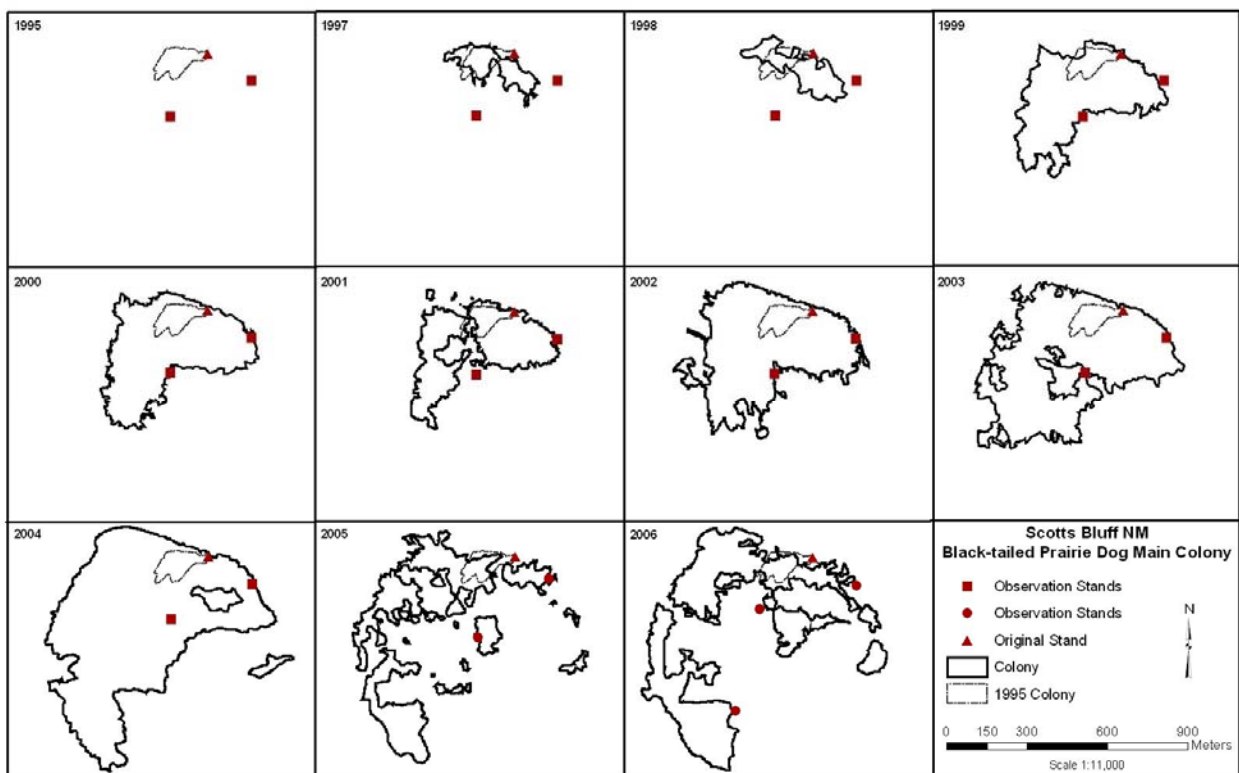


Figure 1. Black-tailed prairie dog (*Cynomys ludovicianus*) colony sizes and shapes at Scotts Bluff National Monument, Nebraska – Main Colony for years 1995 to 2006, exception 1996. The colony size and shape was roughly the same for 1995 and 1996. The colony boundary for 1995 is shown on all years as a reference. Solid squares symbolize the location of monitoring stands from 2001-2004. Circles symbolize the location of monitoring stands in 2005 and 2006.

Using the combined visual count data, two calculations were made to estimate annual BTPD density and abundance within the main colony at SCBL. Similar estimates were also calculated for the colony north of the canal and the Saddle Rock Unit colony. Estimated density (P) is derived from the linear relationship described by Severson and Plumb (1998): $Density (P) = [(Y / Sp) - 3.04] / 0.40$, where Y is the maximum count of individuals in a replicate over the three day survey period and Sp is the total area sampled. Density is calculated from the maximum count of individuals in a replicate and colony size, adjusted for the probability of not observing all individuals during the count. The adjustment coefficient is based on mark-recapture data (Severson and Plumb 1998). The maximum count (out of 24) is used because it is significantly correlated with prairie dog abundance as determined by mark-recapture data. (See Morrison (2004) for an explanation regarding how density is estimated and how the equations were derived.)

Abundance (T) = (Sc)(P), where Sc is the total colony size in hectares and P the estimated density per hectare.

A 95 % confidence interval was calculated for density and abundance using the following formulas:

$$\begin{aligned} \text{Density lower limit, } P &= P - 1.96 [SE(P)] \\ \text{Density upper limit, } P &= P + 1.96 [SE(P)] \\ \text{Abundance lower limit, } T &= T - 1.96 [SE(T)] \\ \text{Abundance upper limit, } T &= T + 1.96 [SE (T)] \end{aligned}$$

Where SE is the standard error for Estimated Density (P) and Abundance (T), respectively. Standard error (SE) is derived by first calculating Variance $(P) = 66 + 0.025 (P - 18.4)^2$ for Density (P) or Variance $(T) = 66 + 0.025 (T - 18.4)^2$ for Abundance (T) and then calculating $SE (P \text{ or } T) = \sqrt{\text{Variance } (P \text{ or } T)}$ (Plumb et. al. 2001). Means with overlapping confidence intervals are not significantly different.

Black-tailed Prairie Dog Colony Mapping

Boundaries of the BTPD colonies at SCBL were delineated using a Global Positioning System (GPS) in conjunction with a PC-based Geographic Information System, ArcGISv.9TM. Colony boundaries were determined by following the active clip line, which was more discernable in 2006 than in years past. When the active clip line was not distinguishable, the boundary was mapped as the area within five meters of active burrows on the perimeter of each colony. Burrows were classified as active if burrow openings were greater than 7-cm in diameter and fresh scat was observed within 0.5-m of the opening. Burrows were not classified as active if there were spider webs across an opening or unclipped vegetation growing in or around the opening (Biggins et. al. 1993, Desmond et. al. 2000). Colored pin flags were used to mark the perimeter of each colony prior to GPS mapping. Boundaries were walked in their entirety in order to close each colony polygon.

Sylvatic Plague Surveillance

Park personnel monitor Sylvatic plague presence within the BTPD colonies at SCBL throughout the year. Observation of a substantial die-off in the population during the year would alert park

personnel to the potential of a Sylvatic plague outbreak. If a Sylvatic plague outbreak is suspected, appropriate authorities will be notified to verify the presence or absence of Sylvatic plague.

Results

Black-tailed Prairie Dog Density and Abundance

Results of BTPD monitoring on the main colony at SCBL between 1995 and 2006 are given in Table 2 and Figures 2 and 3. The density of BTPD on the main colony in 2006 was 20.3 individuals/ha, a decrease of 24.6 individuals/ha from 2005 and lower than the twelve-year average (1995-2006) of 24.7 individuals/ha (Figure 2). However, our estimated density falls within the confidence intervals of all annual estimated densities except in years 1996 and 2005. Density estimates for the colony north of the canal and the one in the Saddle Rock Unit were 34.1 individuals/ha and 17.4 individuals/ha, respectively (Table 3 and 4).

Population size in 2006 for the main colony was estimated at 418.4 individuals, a decrease of 252.3 individuals from 2005 levels (Figure 3). The estimate of BTPD population size (i.e. 418.4 individuals) was 116.6 individuals higher than the twelve year average (1995-2006) of 301.8 individuals / year. The estimated populations for the colony north of the canal and the one in the Saddle Rock Unit were 71.5 and 29.6 individuals, respectively (Table 3 and 4).

Table 2. Annual colony size (95% CI), population density (95% CI) and number of individual black-tailed prairie dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska - Main Colony, between 1995 and 2006.

Year	Area (ha)	Density (individuals/ha)	Population Size
1995	1.4	12 (-4.1-28.1)	17 (1.1-32.9)
1996	1.4	53 (33.9-72.3)	74 (50.5-97.5)
1997	2.6	28.9 (12.7-45.2)	75 (51.3-98.7)
1998	3.3	22.7 (6.7-38.7)	75 (51.3-98.7)
1999	10.5	16.7 (0.8-32.6)	175 (123.9-226.1)
2000	16.2	9.2 (-7.0-25.4)	149 (105.5-192.5)
2001	10.9	23.4 (7.4-39.4)	255 (179.7-329.6)
2002	20.0	19.0 (3.1-34.9)	381 (267.5-494.5)
2003	25.2	31.8 (15.4-48.3)	802 (558.7-1045.5)
2004	36.7	14.4 (-1.5-30.4)	530 (370.7-689.4)
2005	14.9	44.9 (26.9-62.8)	670.7 (467.9-873.5)
2006	20.6	20.3 (4.4-36.2)	418.4 (293.4-543.4)

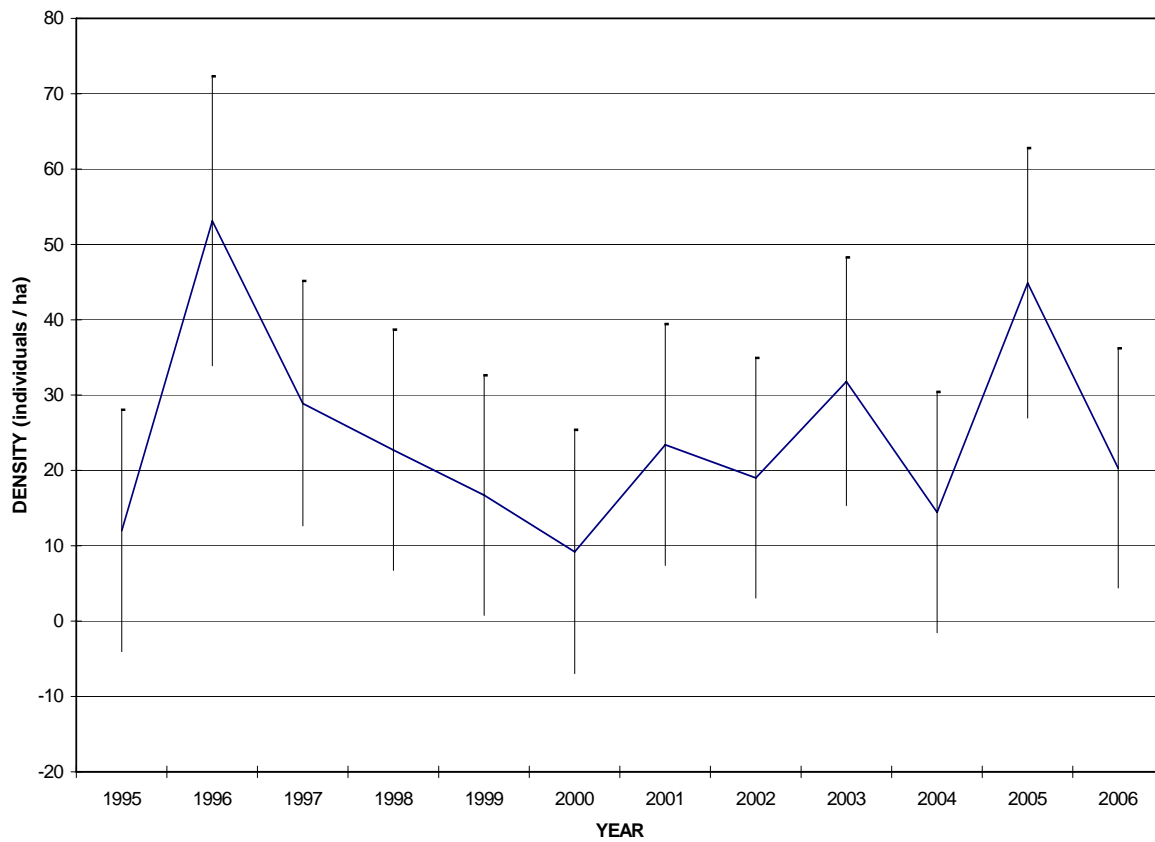


Figure 2. Annual estimates of black-tailed prairie dog densities (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska – Main Colony for years 1995 to 2006. Bars at each annual density estimate represent a calculated confidence interval for that year. Years with widely overlapping confidence intervals about their density estimate are not significantly different.

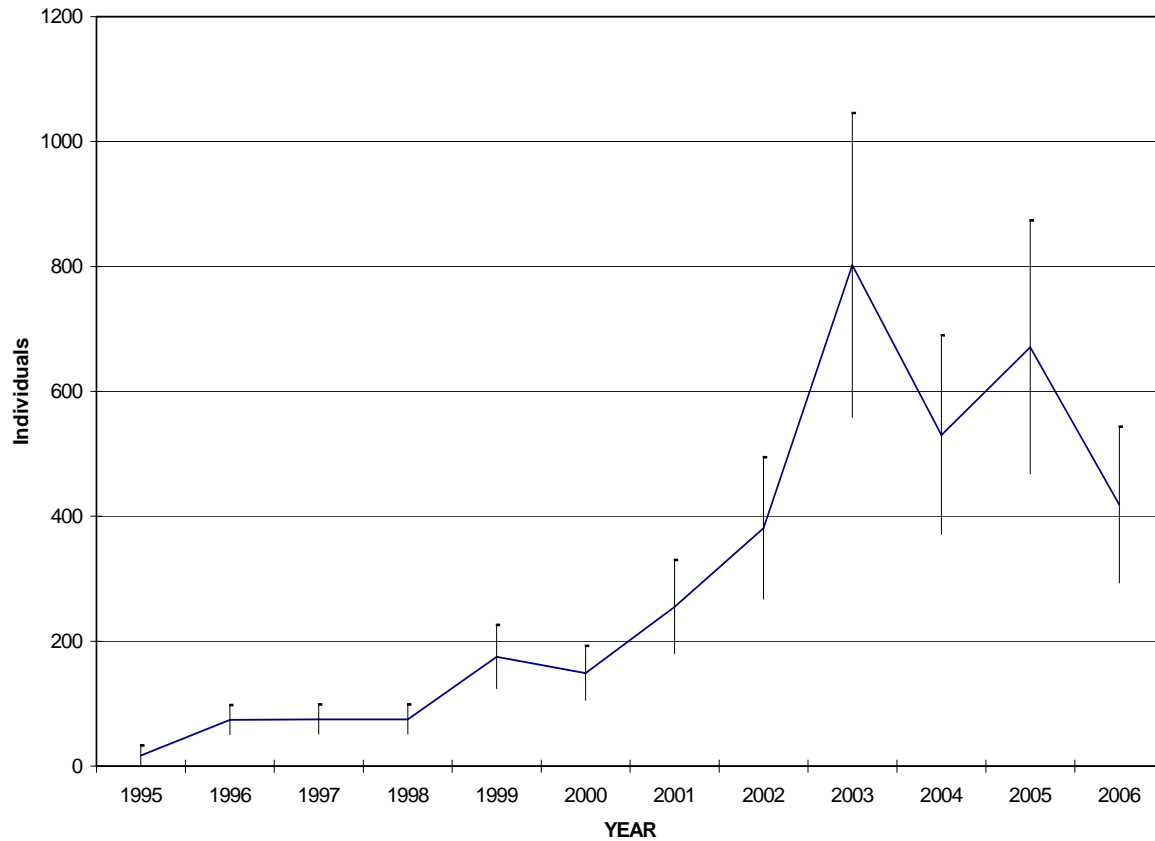


Figure 3. Annual estimates of black-tailed prairie dog population sizes (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska – Main Colony for years 1995 to 2006. Bars at each annual population estimate represent a calculated confidence interval for that year. Years with widely overlapping confidence intervals about their population estimate are not significantly different.

Table 3. Annual colony size (95% CI), population density (95% CI) and number of individual black-tailed prairie dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska - North Colony, between 2003 and 2006.

Year	Area (ha)	Density (individuals\ha)	Population Size
2003	1.7	--	--
2004	2.1	76.9 (52.8-101.0)	163.0 (116.0-211.6)
2005	0.96	80.97 (55.8-106.1)	77.7 (53.4-102.0)
2006	2.1	34.1 (17.4-50..7)	71.5 (48.6 – 94.4)

Table 4. Annual colony size (95% CI), population density (95% CI) and number of individual black-tailed prairie dogs (*Cynomys ludovicianus*) at Scotts Bluff National Monument, Nebraska - Saddle Rock Unit colony, between 2003 and 2006.

Year	Area (ha)	Density (individuals\ha)	Population Size
2003	1.2	--	--
2004	1.1	13.2 (-2.8 - 29.2)	14.3 (-1.7 - 30.3)
2005	0.28	108.7 (76.5-140.9)	30.4 (14.0-46.7)
2006	1.7	17.4 (1.47-33.3)	29.6 (13.3-45.9)

Black-tailed Prairie Dog Colony Mapping

Maps showing changes in the location and extent of the main BTPD colony at SCBL between 1995 and 2006 are shown in Figure 1. The main colony area was 20.602 ha in 2006, representing an increase in size of 5.654 ha from 2005 (Table 2). The shape of the main colony has remained somewhat similar to last year's shape, crescent. However, the colony is more unified this year than it was in 2005 when the colony broke up into small "islands". The 2006 colony size was 7.0 ha larger then the twelve year average of 13.6 ha.

The two other BTPD colonies at SCBL where mapped again in 2006 (Figure 4). The colony north of the canal had an area of 0.96 ha in 2005. It increased to 2.06 ha in 2006, an increase of 1.1 ha (Table 3). This colony borders private lands on its north and west side. There did appear to be several individuals and active burrows on the neighboring private land. The colony located in the Saddle Rock Unit had an area of 0.28 ha in 2005. It increased in size to 1.73 ha in 2006, an increase of 1.45 ha (Table 4).

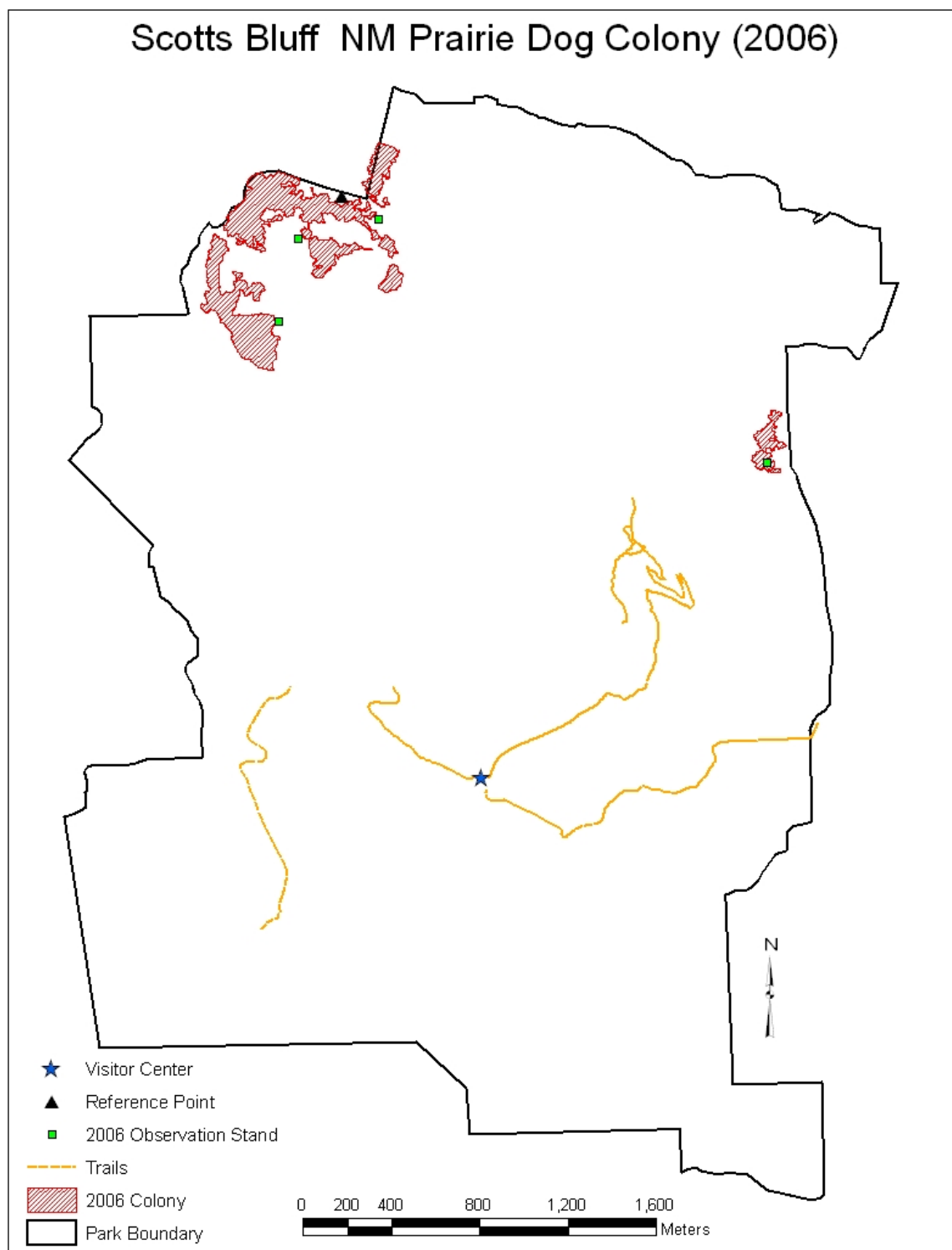


Figure 4. Black-tailed prairie dog (*Cynomys ludovicianus*) colony locations at Scotts Bluff National Monument during 2006.

Sylvatic Plague Surveillance

Sylvatic plague was not observed in the BTPD colonies at SCBL during 2006.

Other Observations

Coincidental counts of burrowing owls on the main colony revealed a total count of four individuals in 2006. Individuals were not observed on the Saddle Rock Unit or the colony north of the canal. Sightings of burrowing owls will continue to be reported.

Discussion

Plumb et al. (2001) recommend conducting visual counts on a single 200 x 200 m section of a colony. However, the small size, unique crescent shape and variation in population densities across the main colony have led us to sample the entire colony by dividing it into three sections for separate visual counts.

It appears that the main colony has not expanded outward to inhabit previously unoccupied habitat as it had in years past (exception 2005). In 2005, the colony decreased in overall size and retreated to small “islands”. In 2006, the BTPD abandoned several of the isolated “islands” and expanded others. This expansion made the colony more cohesive. The colony’s shape is very similar to what it was in 2005, a distinct crescent. Below average precipitation (Figure 5) during the early part of 2006 may have reduced the availability of nutritious vegetation, thus influencing the colony’s size. Black-tailed prairie dogs may have needed to forage over a larger area to meet nutritional needs. Also in 2006, far fewer sweet clover (*Melilotus spp.*) plants were present than in the previous year and the majority of plants present were in their shorter, first year growth stage. This lack of tall vegetation may have contributed to the BTPD abandoning their isolated “islands” and expanding the main colony. Since sweet clover is a biennial, and the seeds are viable in the soil for up to 30 years, this plant may continue to contribute to the shape of the colony (MNDNR 2006).

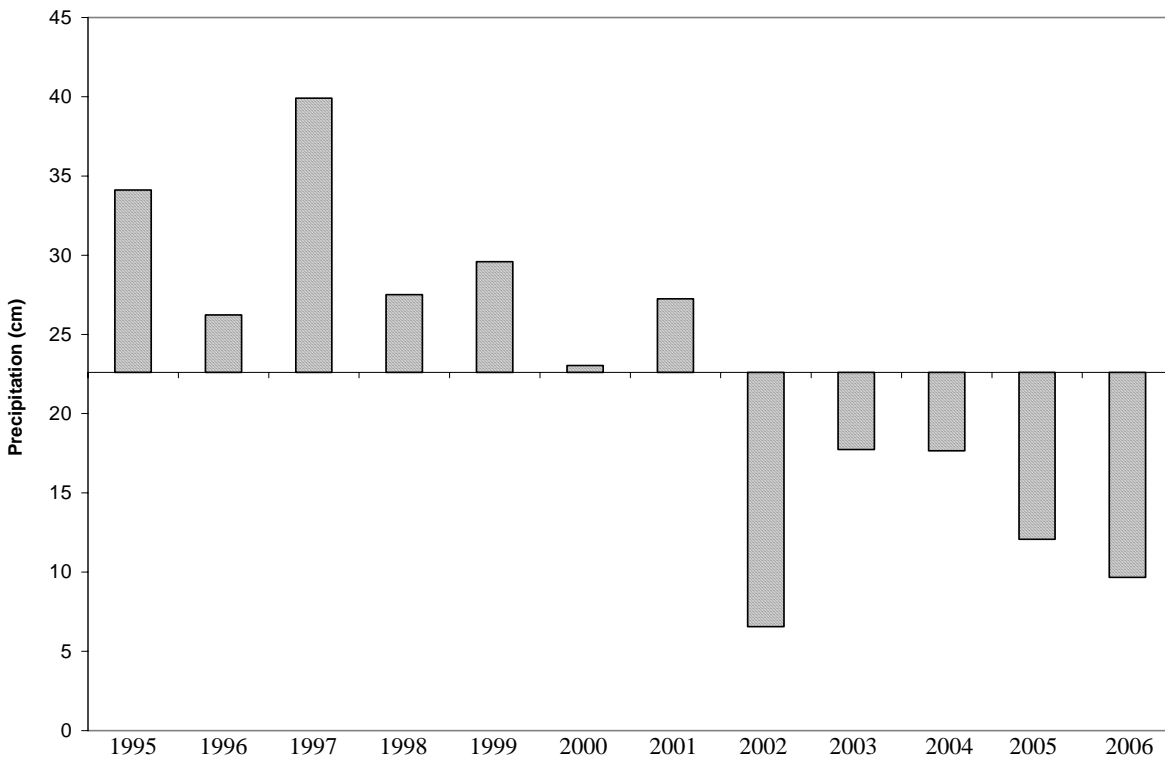


Figure 5. Cumulative precipitation for the first seven months of each year, shown annually as deviations from the twelve year average (1995-2006) at Scotts Bluff National Monument, Nebraska. Annual precipitation averaged 22.61 cm for the first seven months of each year during the twelve year period, 1995-2006.

The BTPD density decline observed on the main colony is not unusual. Annual densities for this colony have decreased from values reported the previous year seven times during our monitoring; years 1997, 1998, 1999, 2000, 2002, 2004, and 2006 (Figure 2). Based on overlapping confidence intervals, 2006 BTPD density was not significantly different than other years. A lower density of BTPD on the main colony contributed to a lower population estimate in 2006 than 2005. Based on overlapping confidence intervals, 2006 population estimates were not significantly different from the previous five years as well.

A decline of approximately six individuals in the north colony population occurred between 2005 and 2006 (Table 3). In 2006, the colony returned to its 2.1 ha size (not necessarily shape) that it exhibited in 2004, after experiencing a size decline in 2005 (Table 3). This expansion in size contributed to a decrease in overall density from 2005 to 2006. The decrease in density was statistically significant based on overlapping confidence intervals. There is some evidence (several active burrows) to suggest that the BTPD are expanding eastward and westward. To the west BTPD are expanding across a fence onto private land (alfalfa field). To the east, BTPD appear to be utilizing a road to bypass a north-south canal.

The BTPD colony in the Saddle Rock Unit showed an increase in total area occupied and a slight decrease in estimated population size. This expansion in colony size and decline in population

contributed to a decreased density from 2005 to 2006. The decrease in density was significant based on overlapping confidence intervals (Table 4).

Presently, the combined colonies occupy only a small portion of the monument (i.e. 3.49% of the monument's 698-ha of grassland). Monument staff should continue to monitor for new occurrences of BTPD colonies in other areas of the monument. Dispersal from colonies outside the monument (most likely the source of the Saddle Rock Unit colony) may produce new colonies at SCBL. Dispersal from colonies within the monument may also lead to new colonies. Dispersal usually begins in late winter and is complete by the end of June (Garrett and Franklin 1988; Hoogland 1995). Black-tailed prairie dog monitoring at SCBL will continue as part of the NPS's effort to address concerns over population status on their lands. Annual monitoring of the colony at SCBL allows resource managers the opportunity to assess the impacts of colony expansion on the cultural and natural resources of the monument, and assess the status of BTPD at SCBL in comparison to other NPS lands. Sylvatic plague surveillance as well as surveillance for other mortality factors will continue to be a routine part of the monitoring of BTPD colonies at SCBL. An investigation of mortality factors must be undertaken if a rapid decline in the BTPD population is observed to minimize the risk to human health without causing undue concerns. Findings from monitoring efforts on BTPD at SCBL should be incorporated with those from other NPS lands in order to help recover this element of the prairie ecosystem to sustainable numbers.

Plans for 2007

Black-tailed prairie dog density, abundance and colony sizes at SCBL will continue to be monitored with methodologies outlined by Plumb et al. (2001). Three observation stands will be used to observe the main BTPD colony if its size and shape dictates they are needed. Monitoring of the two smaller colonies will continue if they persist and continue to grow.

Literature Cited

- Barnes, A.M. 1993. A review of plague and its relevance to prairie dog populations and the black-footed ferret. Pages 28-37 in Oldemeyer, J.L., D.E. Biggins, and B.J. Miller, editors. Proceedings of the symposium on the management of prairie dog complexes for the reintroduction of the black-footed ferret. Biological Report 13. United States Department of Interior, U.S. Fish and Wildlife Service, Washington, DC.
- Biggins, D.E., B.J. Miller, L.R. Hanebury, B. Oakleaf, A.H. Farmer, R. Crete, and A. Dood. 1993. A technique for evaluating black-footed ferret habitat. Pages 73-78 in Oldemeyer, J.L., D.E. Biggins, and B.J. Miller, editors. Proceedings of the symposium on the management of prairie dog complexes for the reintroduction of the black-footed ferret. Biological Report 13. United States Department of Interior, U.S. Fish and Wildlife Service, Washington, DC.
- Cully Jr., J.F. 1993. Plague, prairie dogs and black-footed ferrets: implications for management. Pages 38-49 in Oldemeyer, J.L., D.E. Biggins, and B.J. Miller, editors. Proceedings of the symposium on the management of prairie dog complexes for the reintroduction of the black-footed ferret. Biological Report 13. United States Department of Interior, U.S. Fish and Wildlife Service, Washington, DC.
- Cox, M.K. and W.L. Franklin. 1989. Prairie dog management recommendations for Scott's Bluff National Monument. A Report to the National Park Service, Omaha NE. 30 pp.
- Desmond, M.J., J.A. Savidge, and K.M. Eskridge. 2000. Correlations between burrowing owl and black-tailed prairie dog declines: a 7-year analysis. *The Journal of Wildlife Management* 64:1067-1075.
- Franklin, W.L. 1984. Status of black-tailed prairie dogs as Scott's Bluff National Monument and recommendations for management. Completion Report for the Department of the Interior, U.S. Fish and Wildlife Service, Washington DC. and the National Park Service, Omaha NE. 18 pp.
- Garrett, M.G. and W.L. Franklin. 1988. Behavioral ecology of dispersal in the black-tailed prairie dog. *Journal of Range Management* 69:236-250.
- Hoogland, J.L. 1995. The black-tailed prairie dog: social life of a burrowing mammal. The University of Chicago Press, Chicago IL. 557 pp.
- Hubbard, C.A. 1947. Fleas of western North America. Iowa State College Press, Ames, IA. 533 pp.
- Knowles, C.J. 1998. Status of the black-tailed prairie dog. Report for the U.S. Fish and Wildlife Service, Pierre SD. 12 pp.

- Minnesota Department of Natural Resources (MNDNR). 2006. The Minnesota Department of Natural Resources Web Site (online). Accessed 2006-8-9 at <http://www.dnr.state.mn.us/sitetools/copyright.html>
- Morrison, Lloyd W. 2004. Evaluation of survey methods for black-tailed prairie dog populations at Scott's Bluff National Monument. Heartland I&M Network and Prairie Cluster Prototype Monitoring Program, National Park Service.
- National Wildlife Federation. 2000a. Black-tailed prairie dog state by state status. National Wildlife Federation Home Page (http://www.nwf.org/prairiedogs/dog_status.html).
- National Wildlife Federation. 2000b. Question and answers about the black-tailed prairie dog's warranted but precluded status. National Wildlife Federation Home Page (http://www.nwf.org/prairiedogs/dog_q&a.html).
- Plumb, G.E., G.D. Willson, K. Kalin, K. Shinn, and W.M. Rizzo. 2001. Black-tailed prairie dog monitoring protocol for seven prairie parks. U.S. Department of the Interior, U.S. Geological Survey, Biological Resources Division, Northern Prairie Wildlife Research Center, Missouri Field Station, Columbia. 26 pp.
- Severson, K.E. and G.E. Plumb. 1998. Comparison of methods to estimate population densities of black-tailed prairie dogs. *Wildlife Society Bulletin* 26:859-866.
- U.S. Fish and Wildlife Service. 2000. Twelve-month finding for a petition to list the black-tailed prairie dog as threatened. *Federal Register* 2/4/2000. 65(24):5476-5488.
- U.S. Fish and Wildlife Service. 2004. Findings for the resubmitted petition to list the black-tailed prairie dog as threatened. *Federal Register* 8/18/2004. 69(159):51217-51226.

The NPS has organized its parks with significant natural resources into 32 networks linked by geography and shared natural resource characteristics. HTLN is composed of 15 National Park Service (NPS) units in eight Midwestern states. These parks contain a wide variety of natural and cultural resources including sites focused on commemorating civil war battlefields, Native American heritage, westward expansion, and our U.S. Presidents. The Network is charged with creating inventories of its species and natural features as well as monitoring trends and issues in order to make sound management decisions. Critical inventories help park managers understand the natural resources in their care while monitoring programs help them understand meaningful change in natural systems and to respond accordingly. The Heartland Network helps to link natural and cultural resources by protecting the habitat of our history.

The I&M program bridges the gap between science and management with a third of its efforts aimed at making information accessible. Each network of parks, such as Heartland, has its own multi-disciplinary team of scientists, support personnel, and seasonal field technicians whose system of online databases and reports make information and research results available to all. Greater efficiency is achieved through shared staff and funding as these core groups of professionals augment work done by individual park staff. Through this type of integration and partnership, network parks are able to accomplish more than a single park could on its own.

The mission of the Heartland Network is to collaboratively develop and conduct scientifically credible inventories and long-term monitoring of park “vital signs” and to distribute this information for use by park staff, partners, and the public, thus enhancing understanding which leads to sound decision making in the preservation of natural resources and cultural history held in trust by the National Park Service.

www.nature.nps.gov/im/units/htln/



The Department of the Interior protects and manages the nation’s natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

**National Park Service
U.S. Department of the Interior**



Natural Resource Program Center

Natural Resource Program Center
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov

EXPERIENCE YOUR AMERICA™